CLAIMS

I claim:

1. A hybrid-secondary uncluttered permanent magnet machine, comprising:

a stator having coils for receiving ac electrical power to provide a magnetic field;

a permanent magnet rotor spaced from the stator to define a first air gap relative to an axis of rotation for the permanent magnet rotor;

a magnetic coupling uncluttered rotor spaced from the permanent magnet rotor to define a second air gap relative to an axis of rotation for the permanent magnet rotor;

at least one stationary core and secondary coil spaced from the magnetic coupling uncluttered rotor by a third air gap;

wherein the magnetic coupling uncluttered rotor is provided with a plurality of magnetic elements for coupling flux to the secondary coil; and

wherein the secondary coil is disposed around an axis of rotation for the rotor to allow induction of a slip energy current in the coil without inducing a rotational energy current.

2. The machine of claim 1, wherein the first air gap is an axial air gap disposed along the axis of rotation of the rotor, wherein the second air gap is an axial air gap disposed along the axis of rotation of the rotor, and wherein the third air gap is an axial air gap disposed along the axis of rotation of the rotor.

3. The machine of claim 1, wherein the magnetic elements are provided in pairs for each electrical phase of power supplied to the stator coils.

4. The machine of claim 2, wherein each pair of magnetic elements is spaced apart in a radial direction by a non-magnetic ring on a side of the rotor facing the least one stationary, secondary core and coil.

5. The machine of claim 1, wherein the magnetic elements are magnetic brushes made of stacked metal laminations.

6. The machine of claim 1, wherein the magnetic elements are magnetic brushes made of a compressed powder material having ferromagnetic properties.

7. The machine of claim 1 wherein the magnetic elements are magnetic brushes made of ferromagnetic wires.

8. The machine of claim 1 wherein the magnetic coupling uncluttered rotor is made of electrically conducting non-magnetic material in portions which support and separate the magnetic elements.

9. The machine of claim 1, wherein the permanent magnet rotor has permanent magnets positioned to provide alternating polarity, said permanent magnets being aligned along radii of the permanent magnet rotor.

10. The machine of claim 9, wherein the said permanent magnets are in a round shape.

11. The machine of claim 1, wherein the machine is an ac induction machine.

12. The machine of claim 1, wherein the machine is a motor.

13. The machine of claim 12, wherein the machine is a synchronous motor.

14. The machine of claim 12, wherein the machine is a brushless dc motor.

15. The machine of claim 1, wherein the machine is a generator.

16. The machine of claim 1, wherein there are a plurality of stationary, secondary cores with secondary coils spaced from the rotor by the secondary air gap and disposed around the axis of rotation for the rotor.

17. The machine of claim 16, wherein the secondary coils are adapted to be connected to supply slip energy to a resistive load.

18. A method of providing slip energy control in an electrical machine, the method comprising:

inducing a flux in a magnetic coupling uncluttered rotor across an air gap by conducting a current in a primary winding of the stator and by positioning a permanent magnet rotor with permanent magnets in said air gap;

positioning a secondary coil across a second air gap from the rotor; and

inducing a slip current in the secondary coil by magnetically coupling the flux through the rotor without inducing a current in the rotor.

19. The method of claim 18, further comprising supplying a dc current in the secondary coil to produce a dc flux in the uncluttered rotor.

20. The method of claim 18, wherein the primary air gap is disposed axially along an axis of rotation for the rotor and wherein the second air gap is also disposed axially along an axis of rotation for the rotor.

21. The method of claim 18, wherein the machine is operated as an ac induction machine.

22. The method of claim 18, wherein the machine is operated as a motor.

23. The method of claim 18, wherein the machine is operated as a generator.

24. The method of claim 18, wherein a dc excitation is provided to the secondary coil for operating the machine at synchronous speed.

25. The method of claim 18, wherein a dc excitation is provided to the secondary coil for operating the machine as a brushless dc machine.